



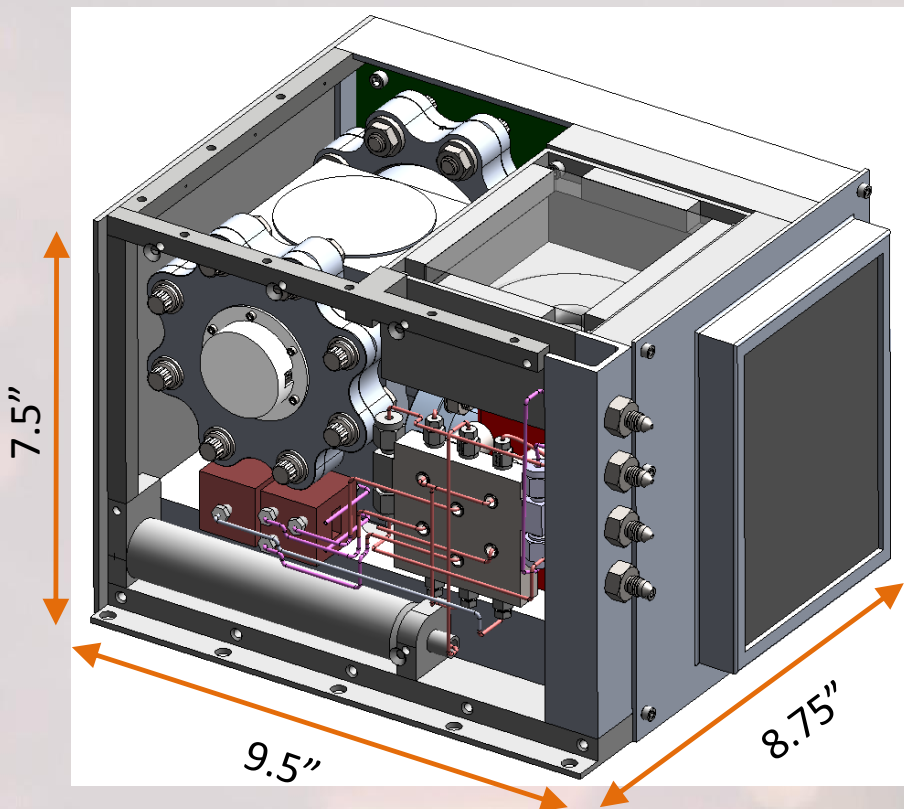
# Progress Report on the Spacecraft **A**tmosphere **M**onitor's Development Model

Stojan Madzunkov R. Kidd B. Bae J. Simcic S. Schowalter J. Gill R. Schaefer E. Diaz M. L. Homer D. Nikolić  
and  
M. Darrach

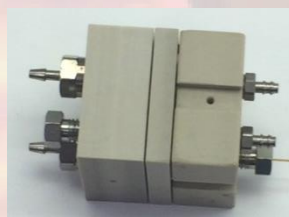
# Comparison between VCAM and S.A.M.

Parameter	VCAM	S.A.M.	Comment
<i>Mass</i>	32.6 kg, (+ 5.3 kg consumables module)	9.5 kg including consumables)	1/3 Mass
<i>Dimensions</i>	10.8" x 18.1" x 20.4"	9.5" x 8.75" x 7.5"	Reduce Volume
<i>Volume</i>	64.4 ℓ	10 ℓ	1/6 Volume
<i>Average Power During Measurement</i>	120 W	45 W	1/3 Power
<i>Operation</i>	Hard Mount	Mobile	Portable
<i>Start-up Time</i>	2.5 hours	< 2 minutes	Tolerance to dormancy/on-off cycles
<i>Operation Mode</i>	On demand	Continuous MCA , TG on demand	Continuous operation
<i>Time to make an MCA Measurement</i>	3-5 Hrs	Every 2 seconds	Dramatically reduced response time
<i>Time to make a Trace VOC (TG) Measurement</i>	40 min	10 min	Reduce response time

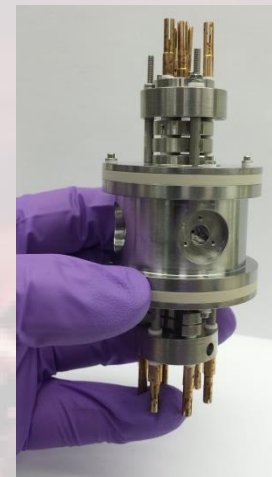
# S. A. M. Concept



- 9. MEMS GC
- 10. MEMS PC
- 11. MEMS (electrostatic) valves
- 12. H<sub>2</sub> as carrier gas



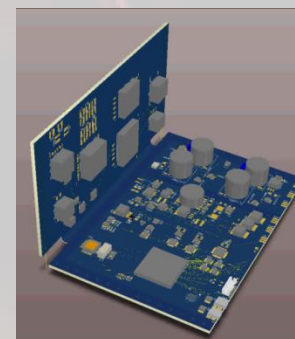
- 1. Smaller **UHV** Chamber
- 2. New Sensor: ion gun & detector
- 3. "Wireless" design



- 4. Pumping system: **ion + getter**

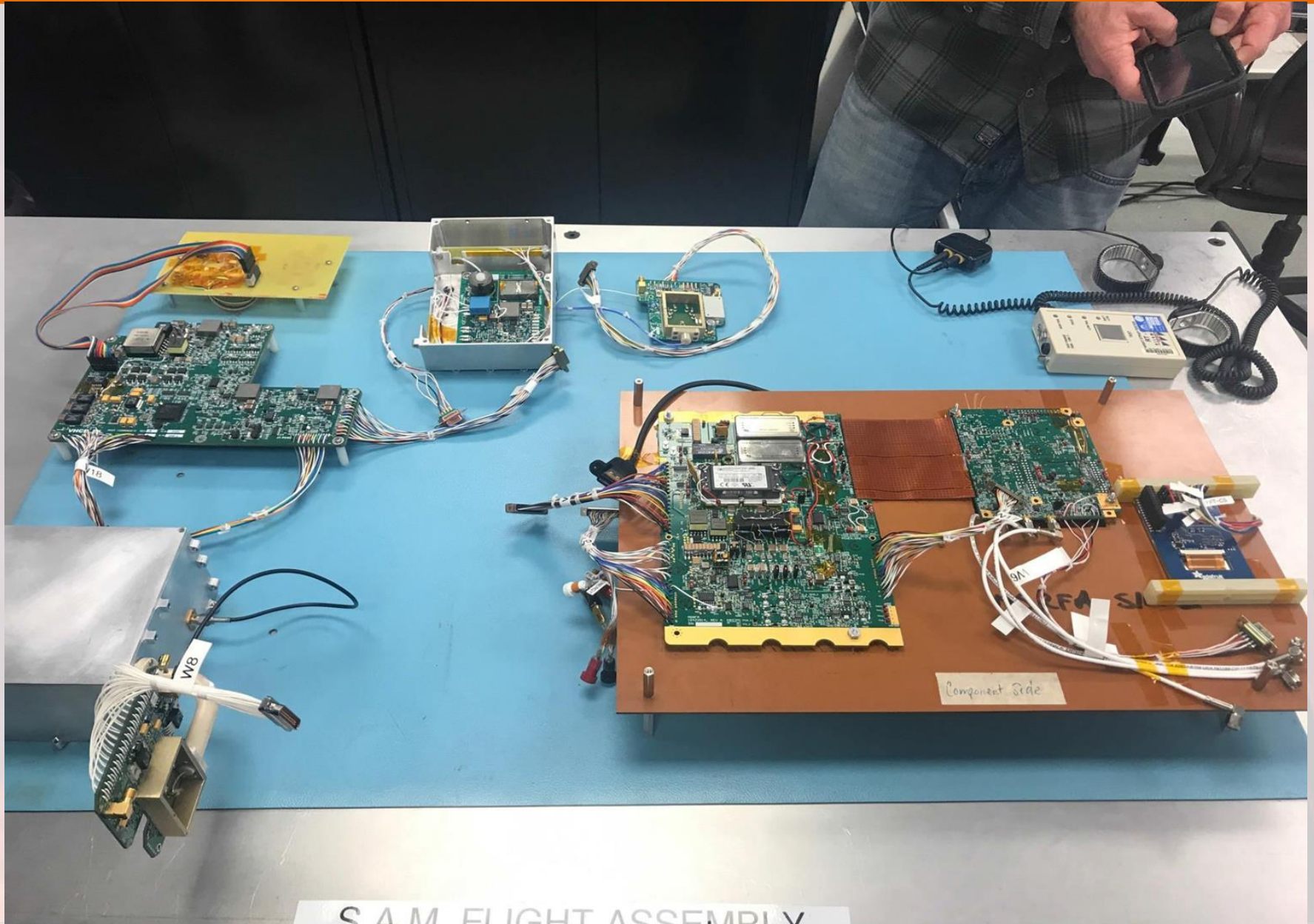


- 5. **3 RF sources**
- 6. High power amplifier
- 7. High Q, high voltage **air-core** resonant tank
- 8. Folding electronics design





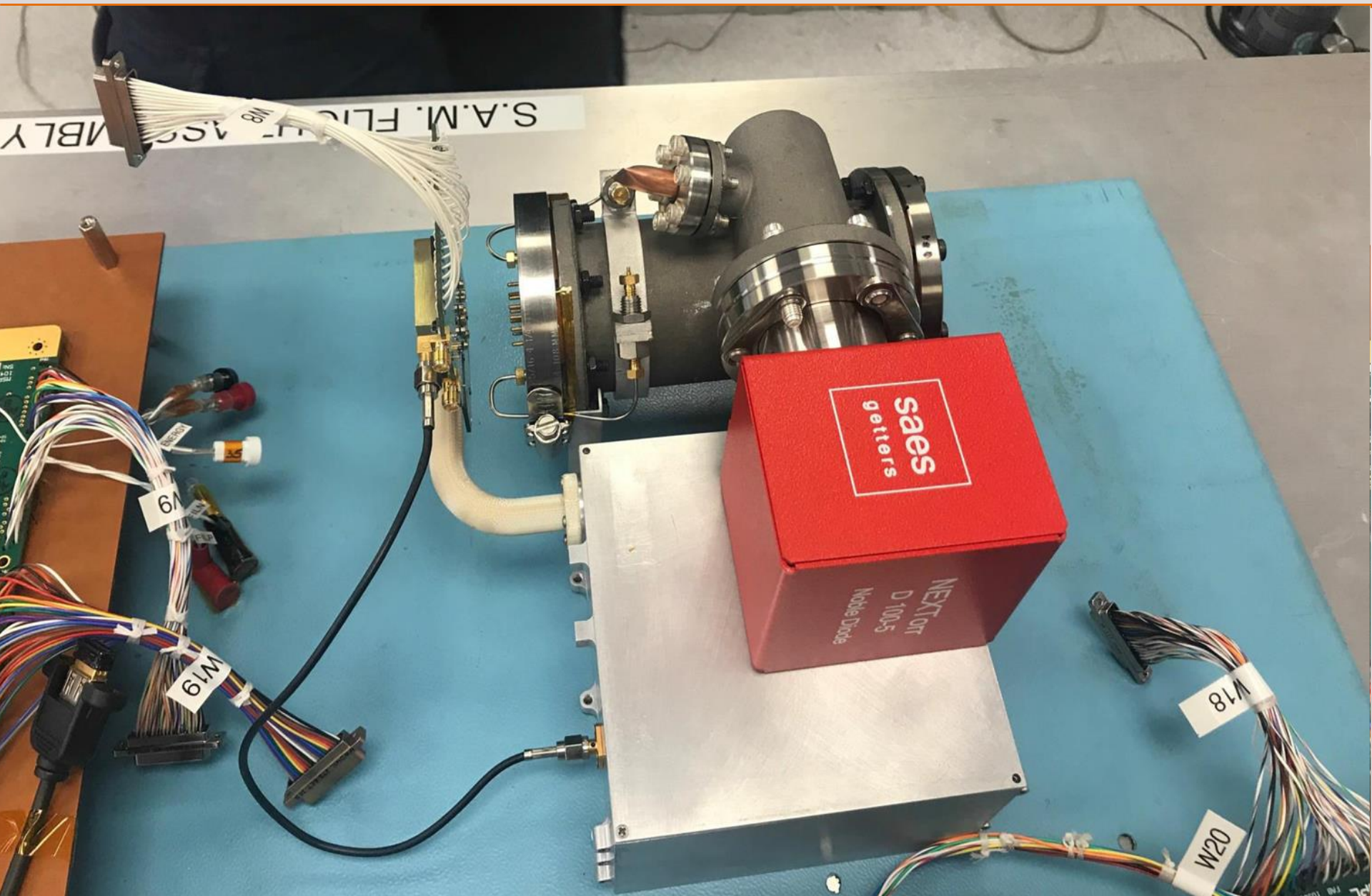
# S.A.M. Electronics – 04/17/17



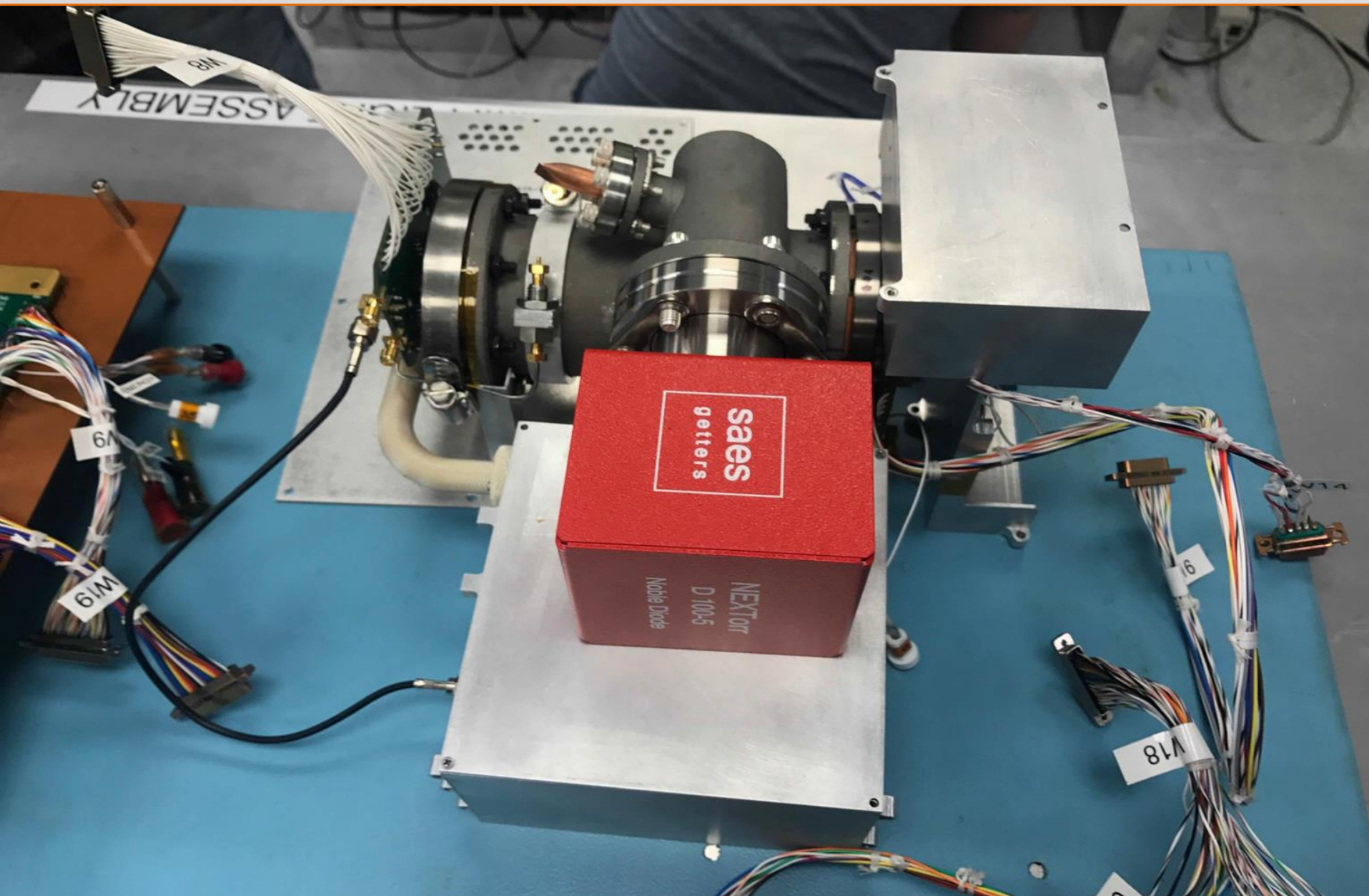
S.A.M. FLIGHT ASSEMBLY



# S.A.M. Mass Spectrometer

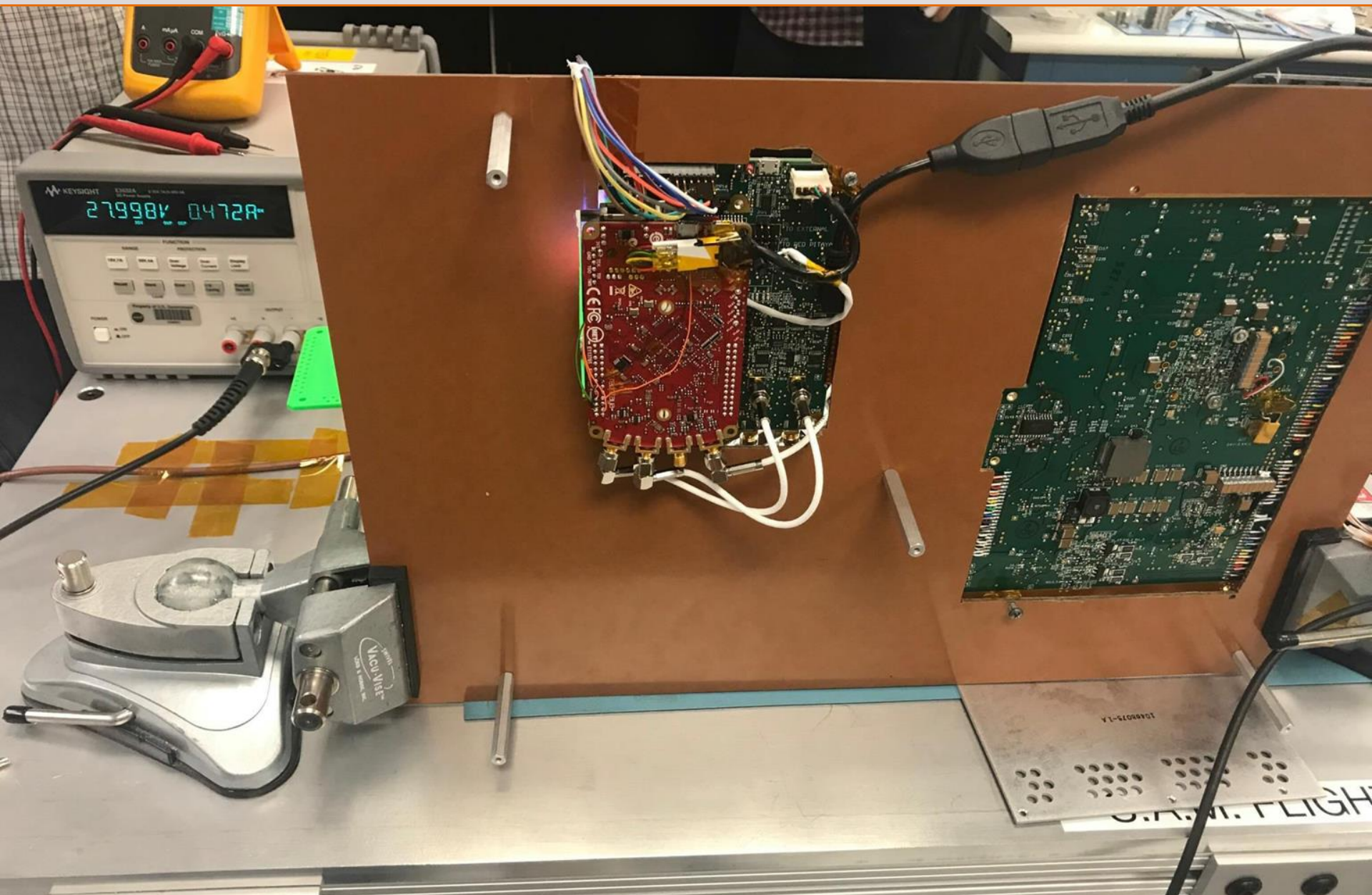


# S.A.M. Mass Spectrometer to Electronics - Integration

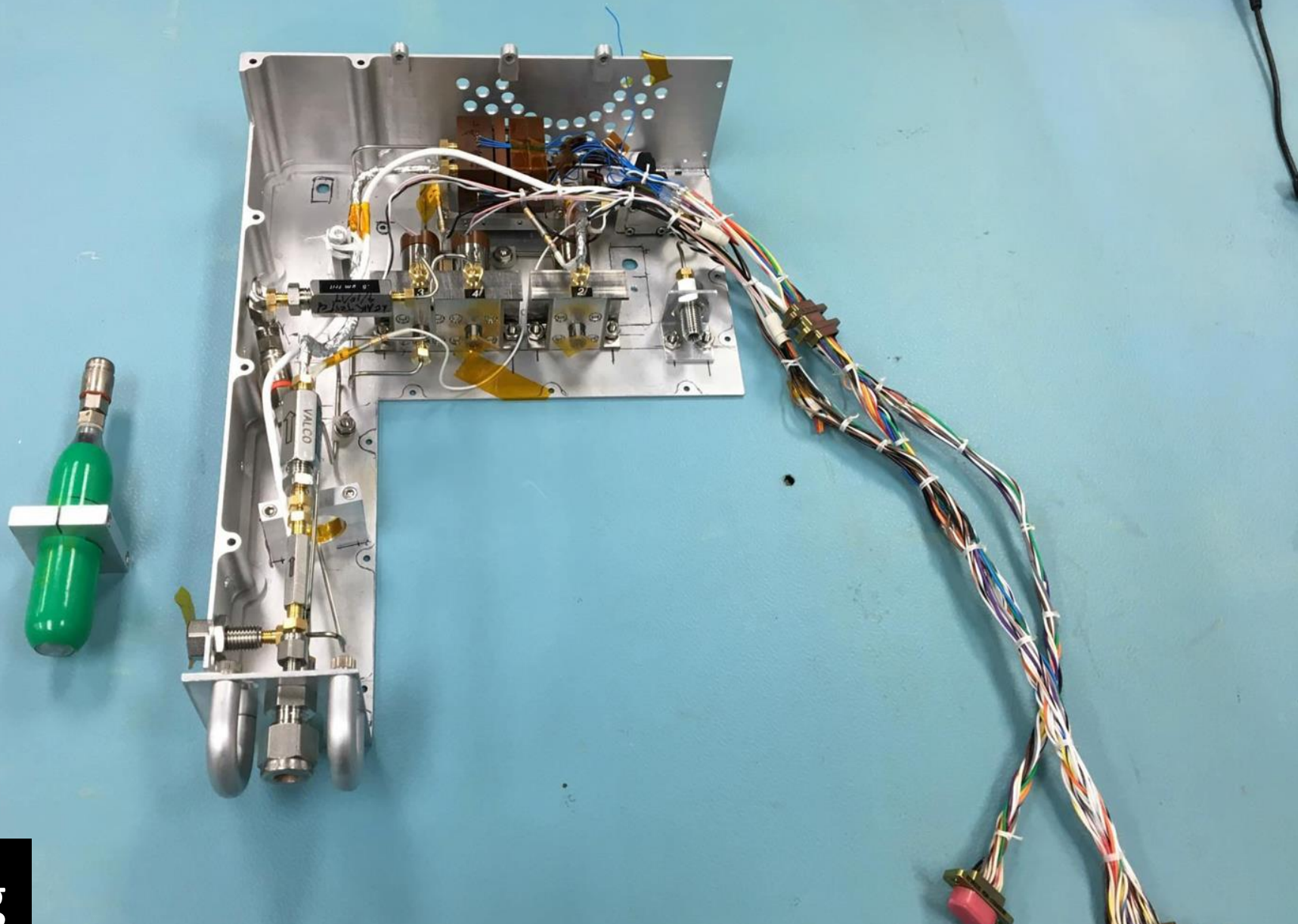




# S.A.M. Power On: 750kHz, 14W



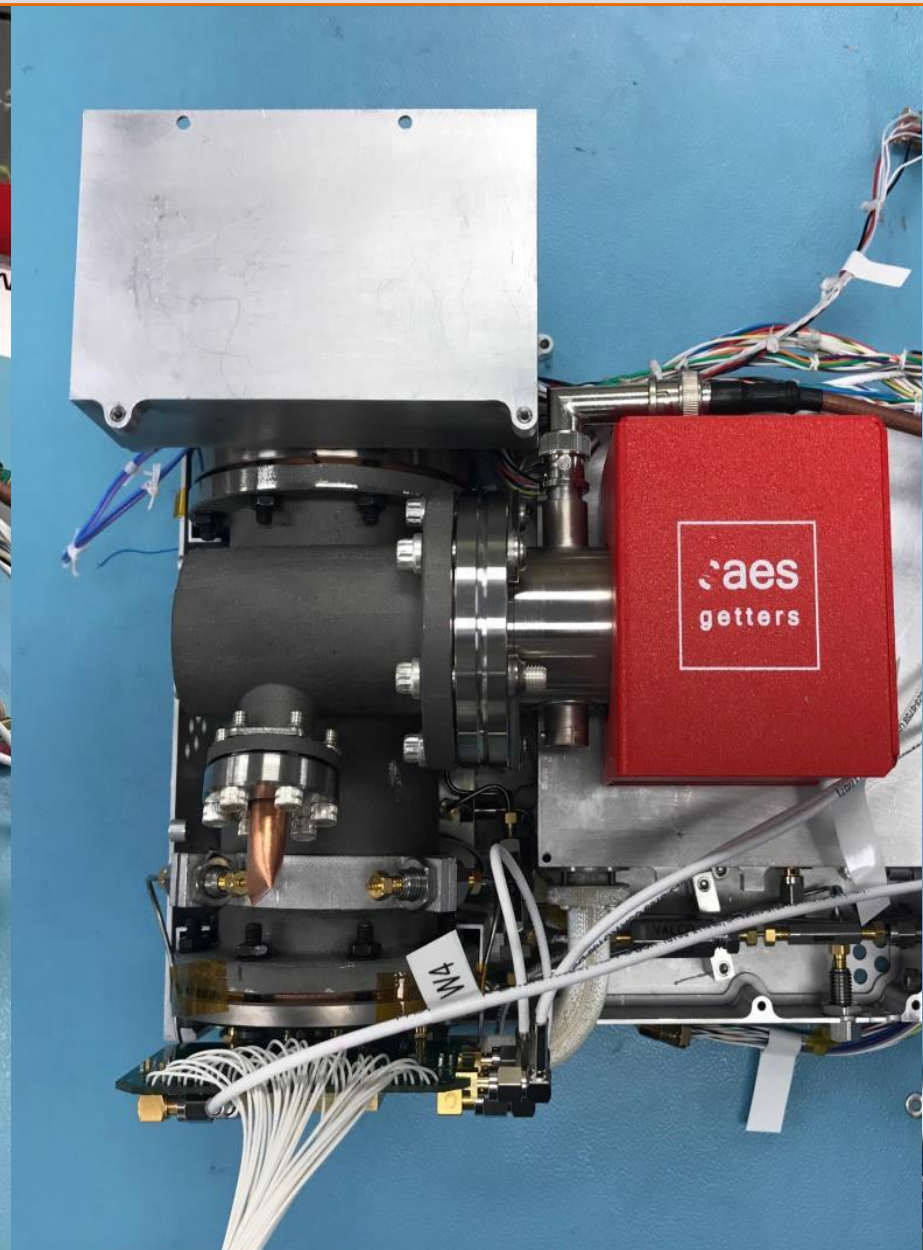
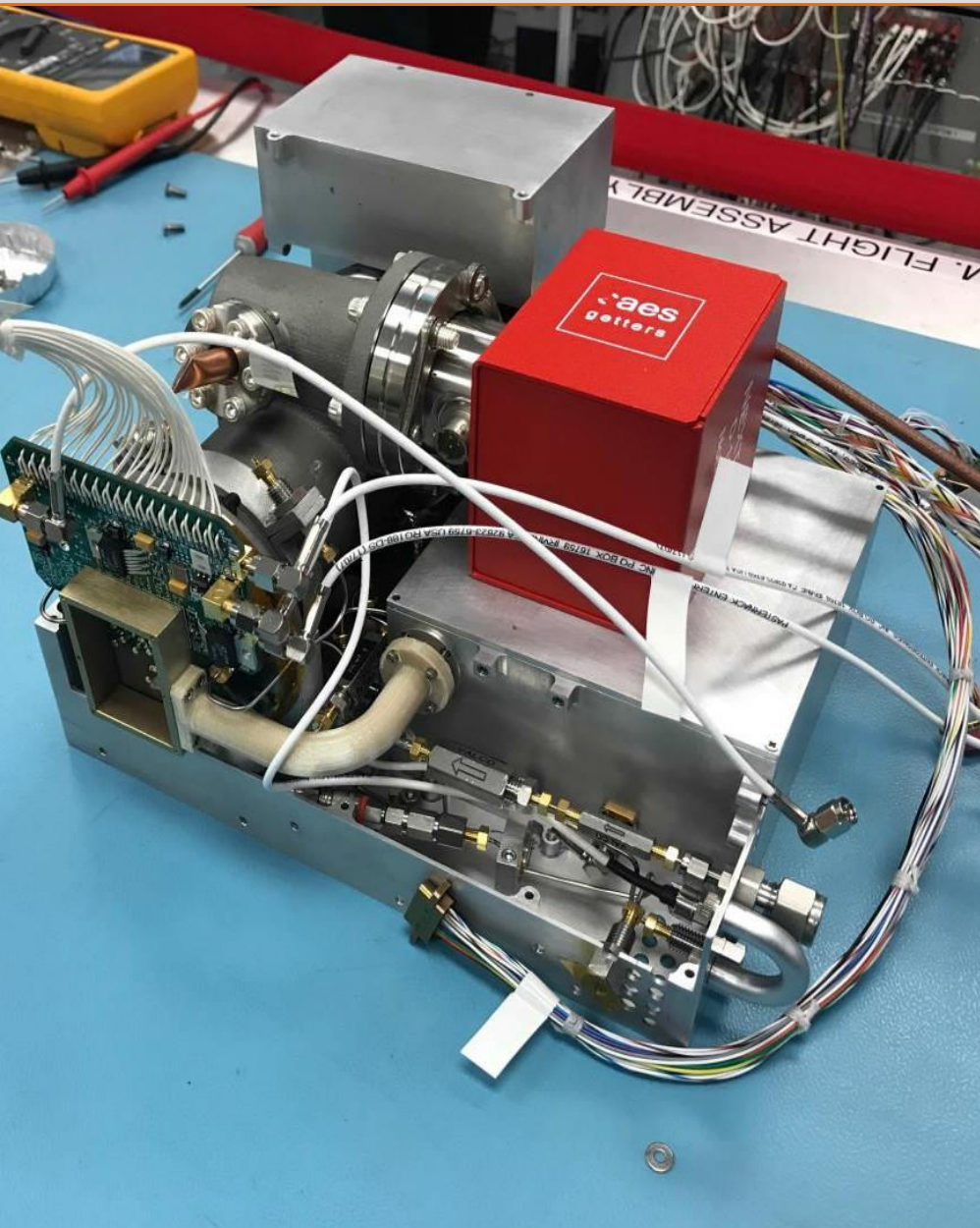
# S.A.M. PCGC Assembly



930 g

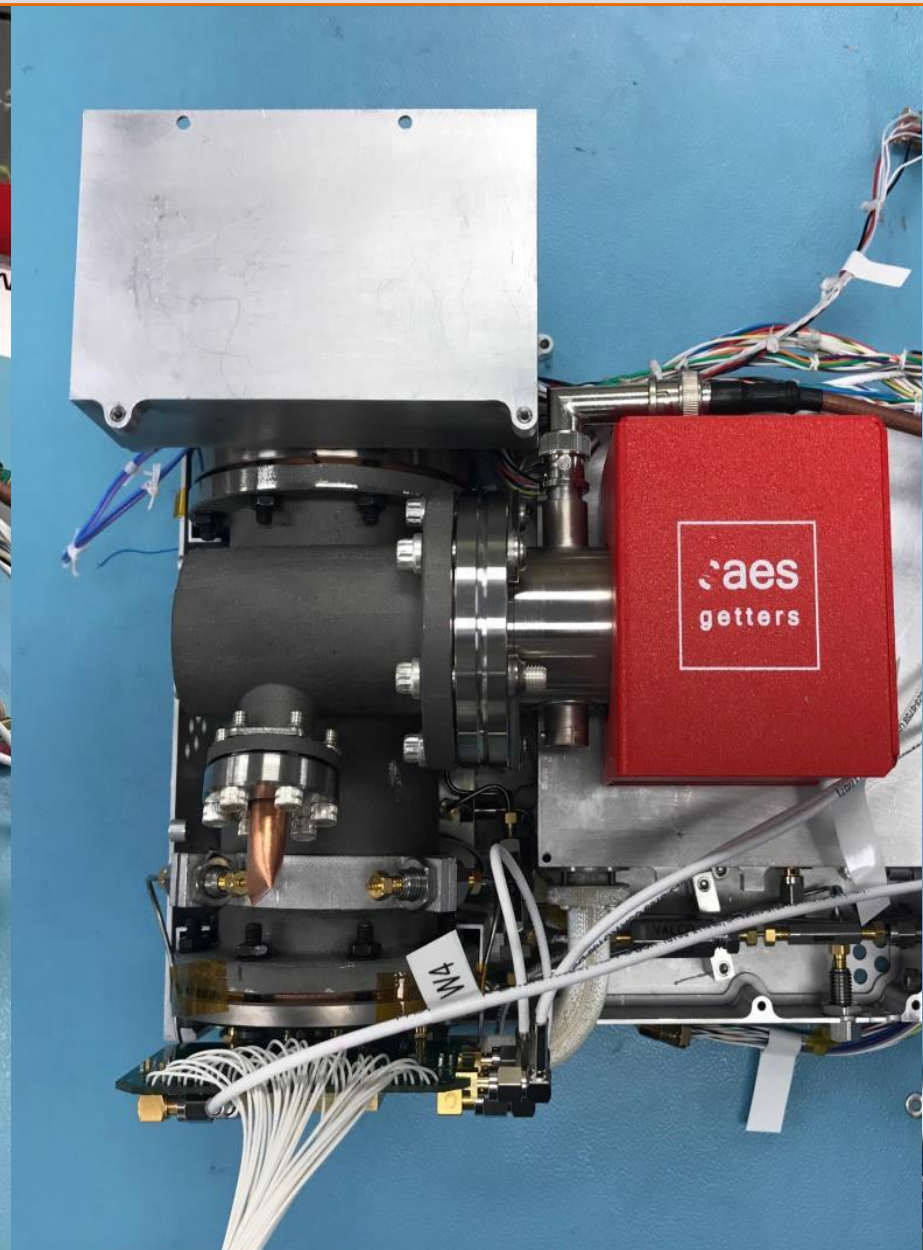
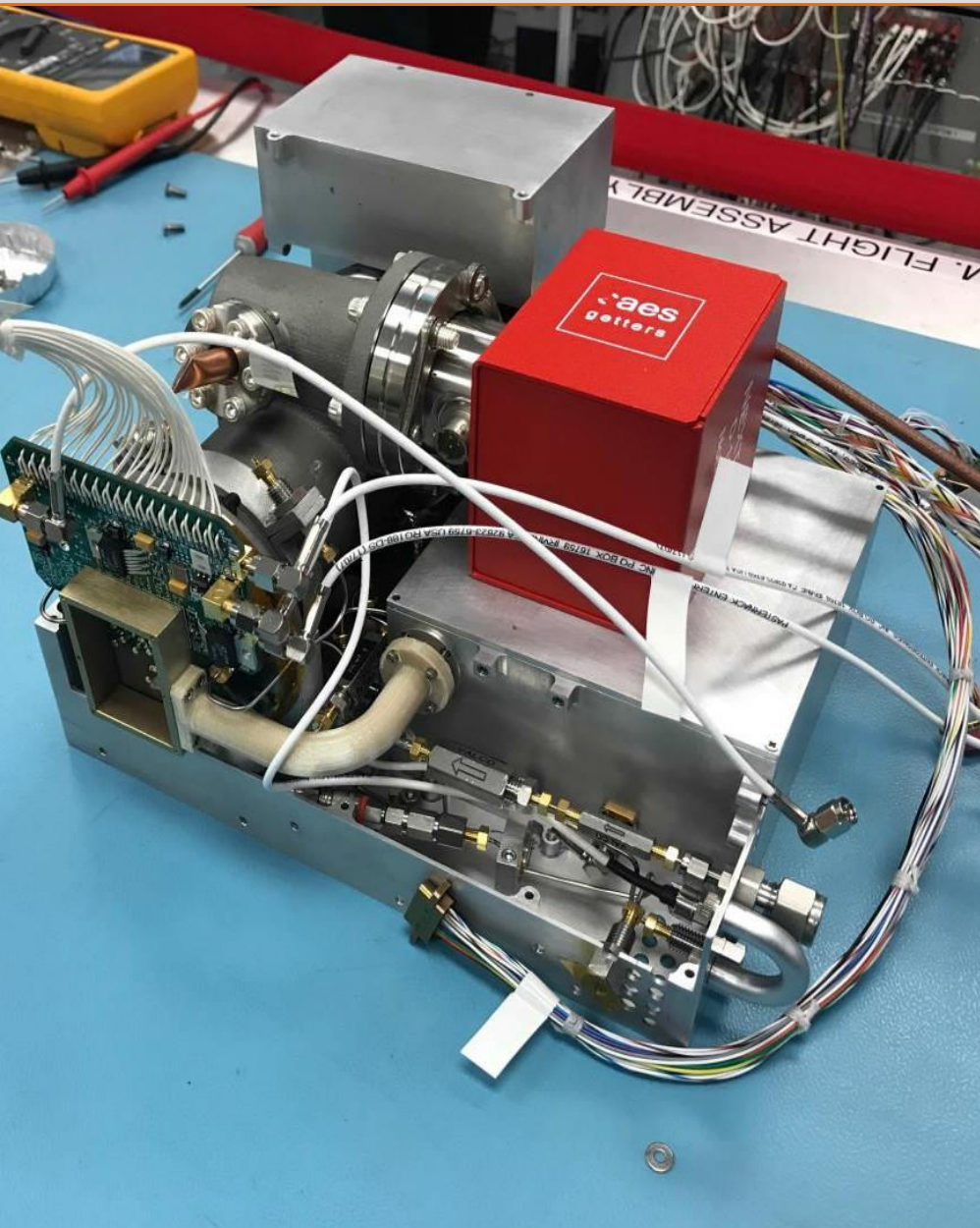


# DM – 4/18/17



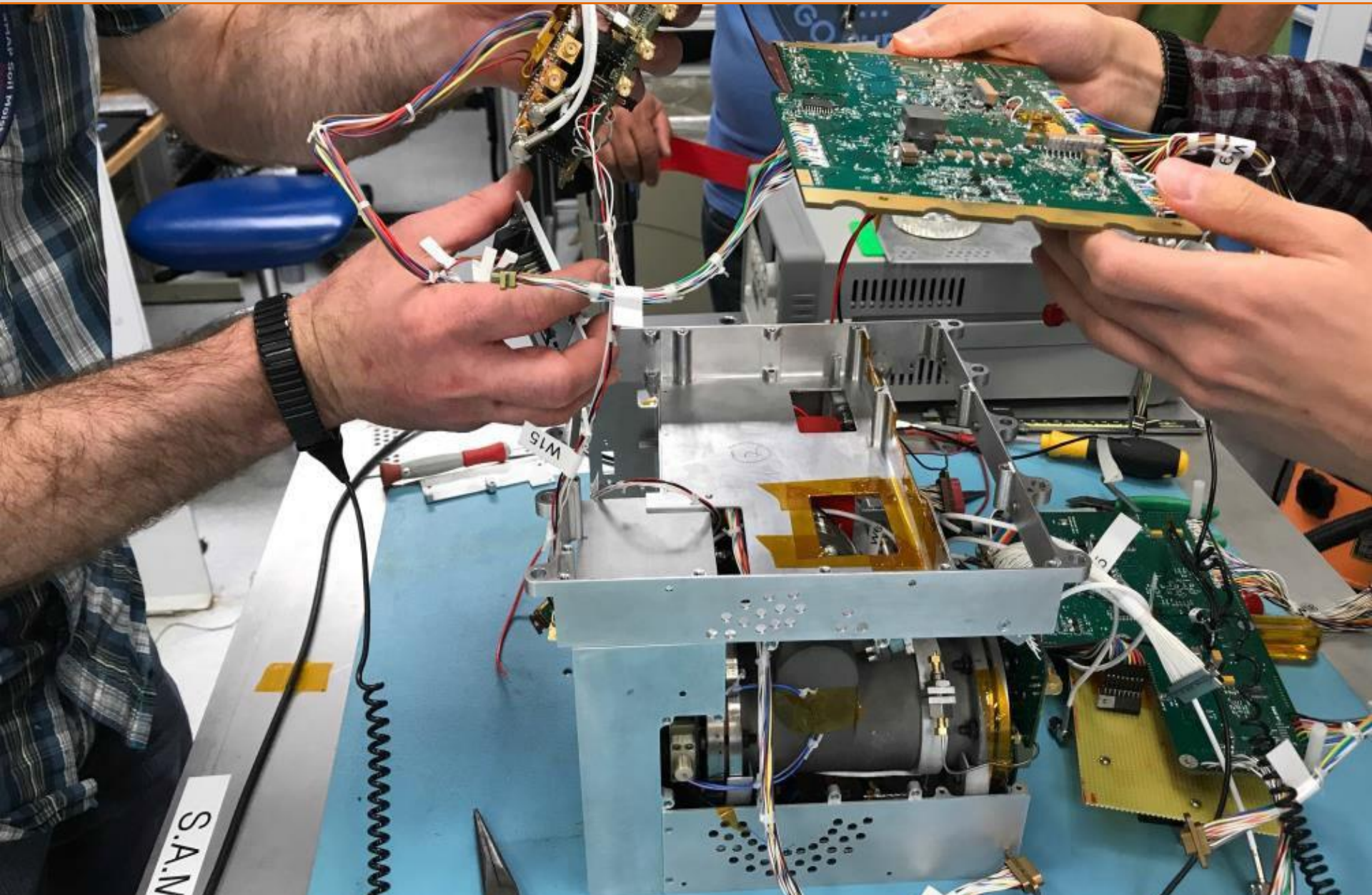


# DM – 4/18/17



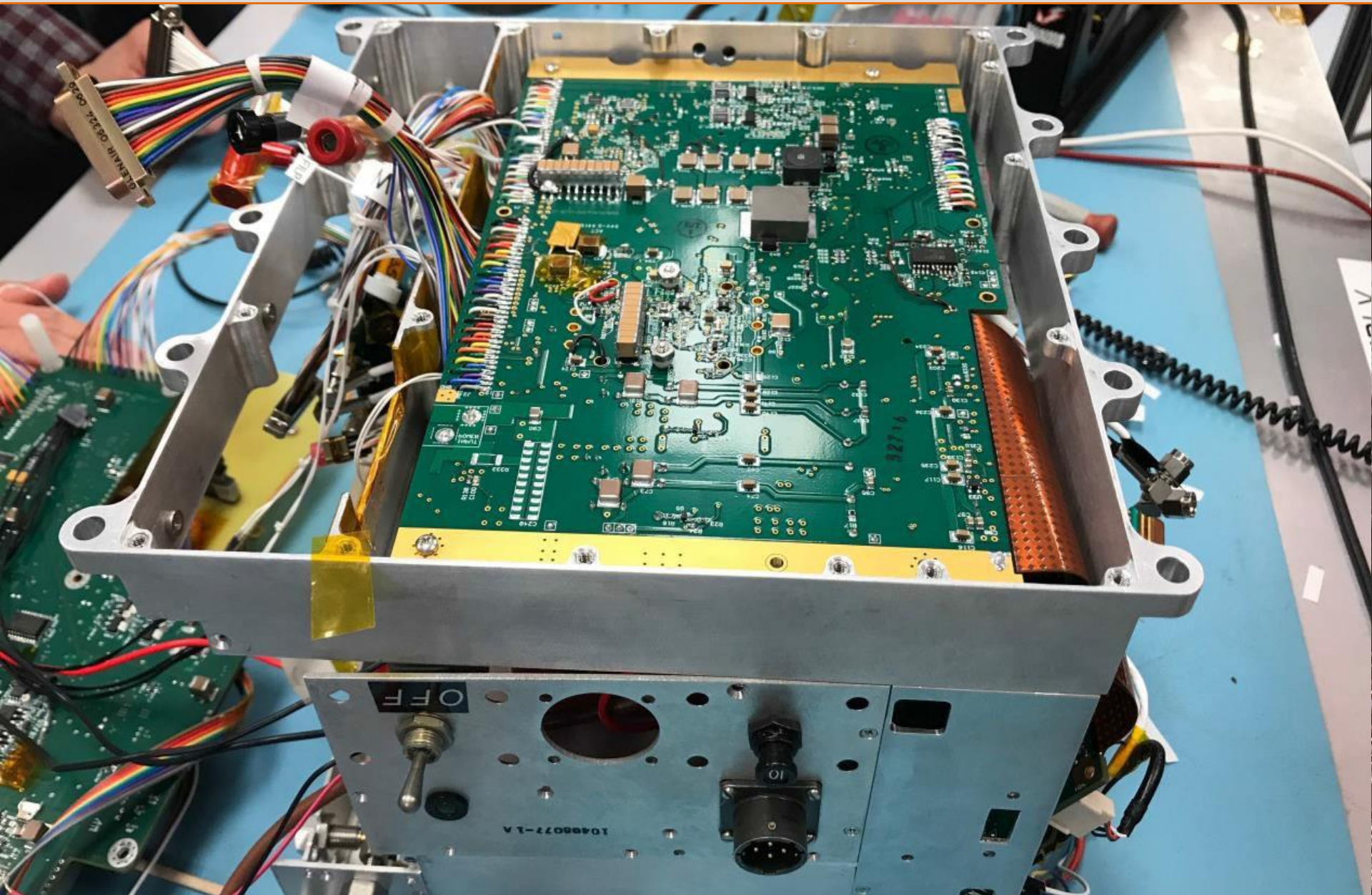


## Mating MSRFA to Chassis





## Mating MSRFA to Chassis

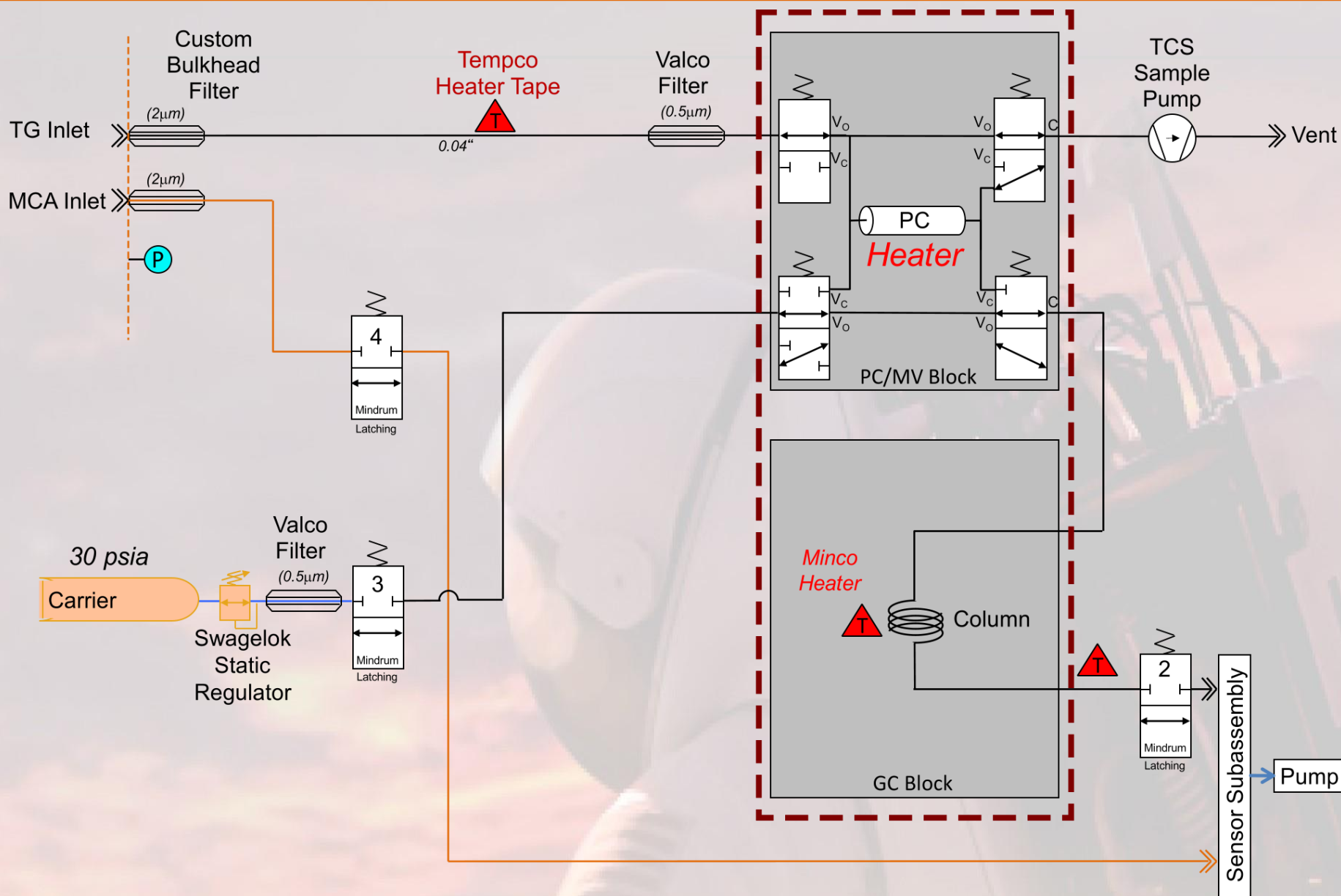




# SAM DM – 4/20/17

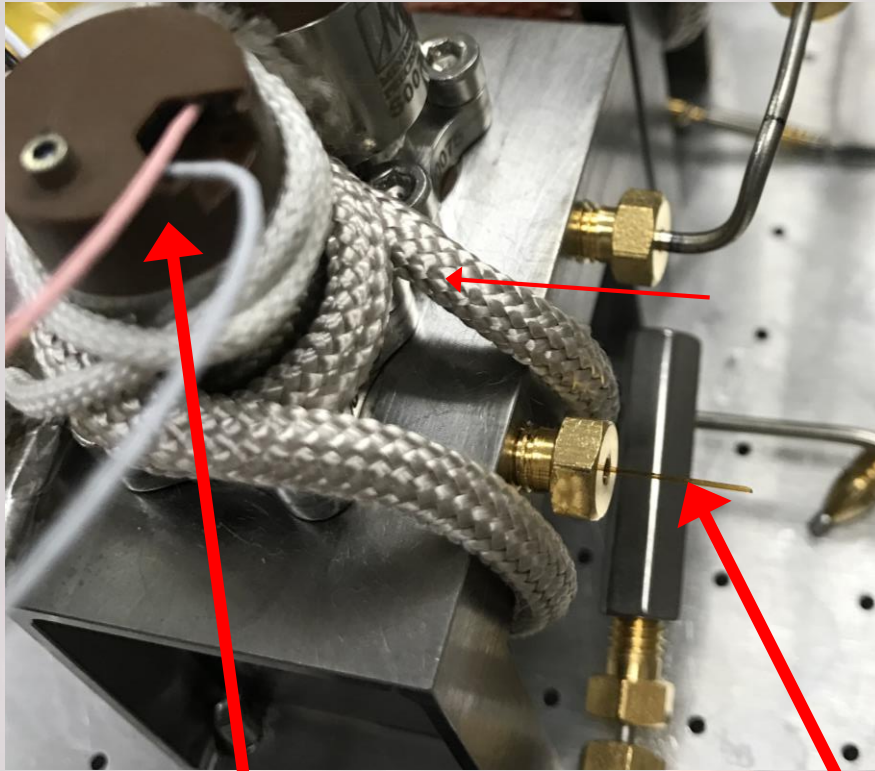


# S.A.M. Schematics



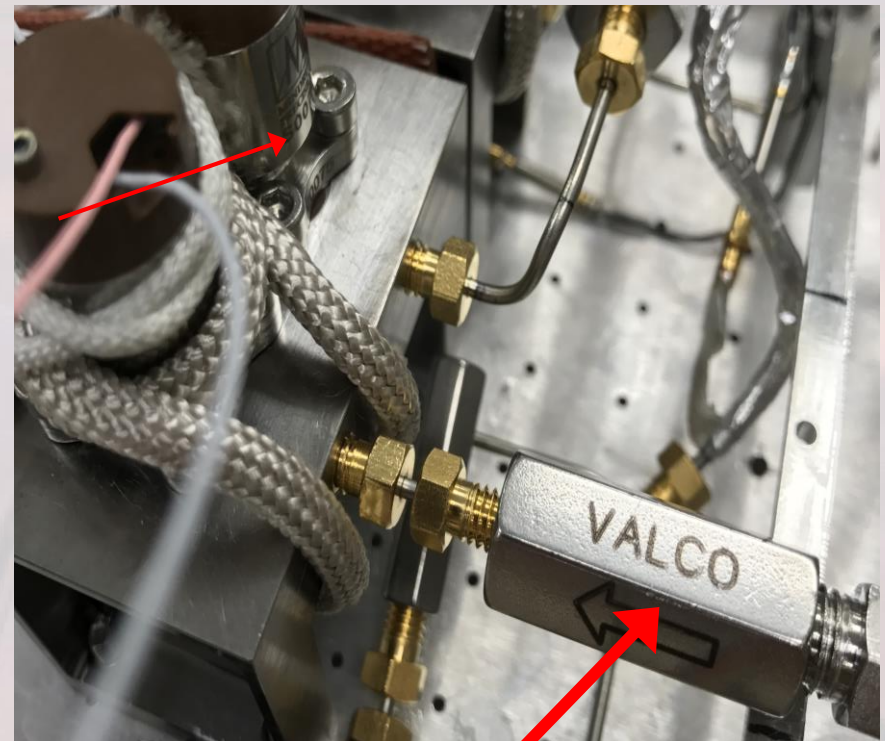


## S.A.M. MCA



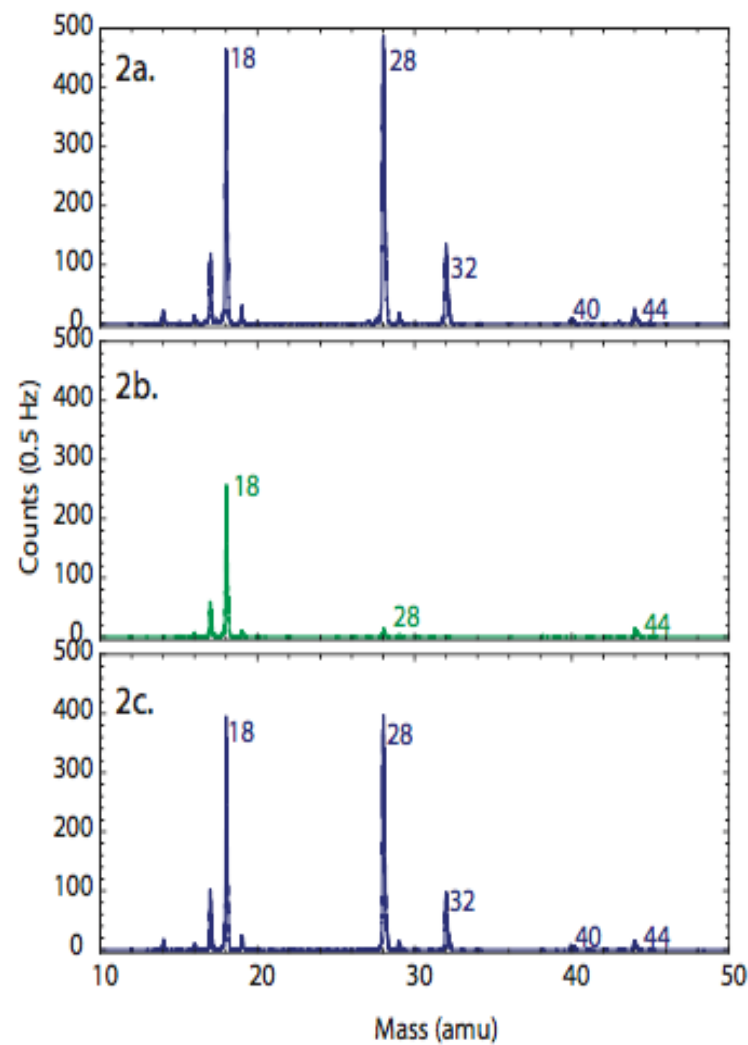
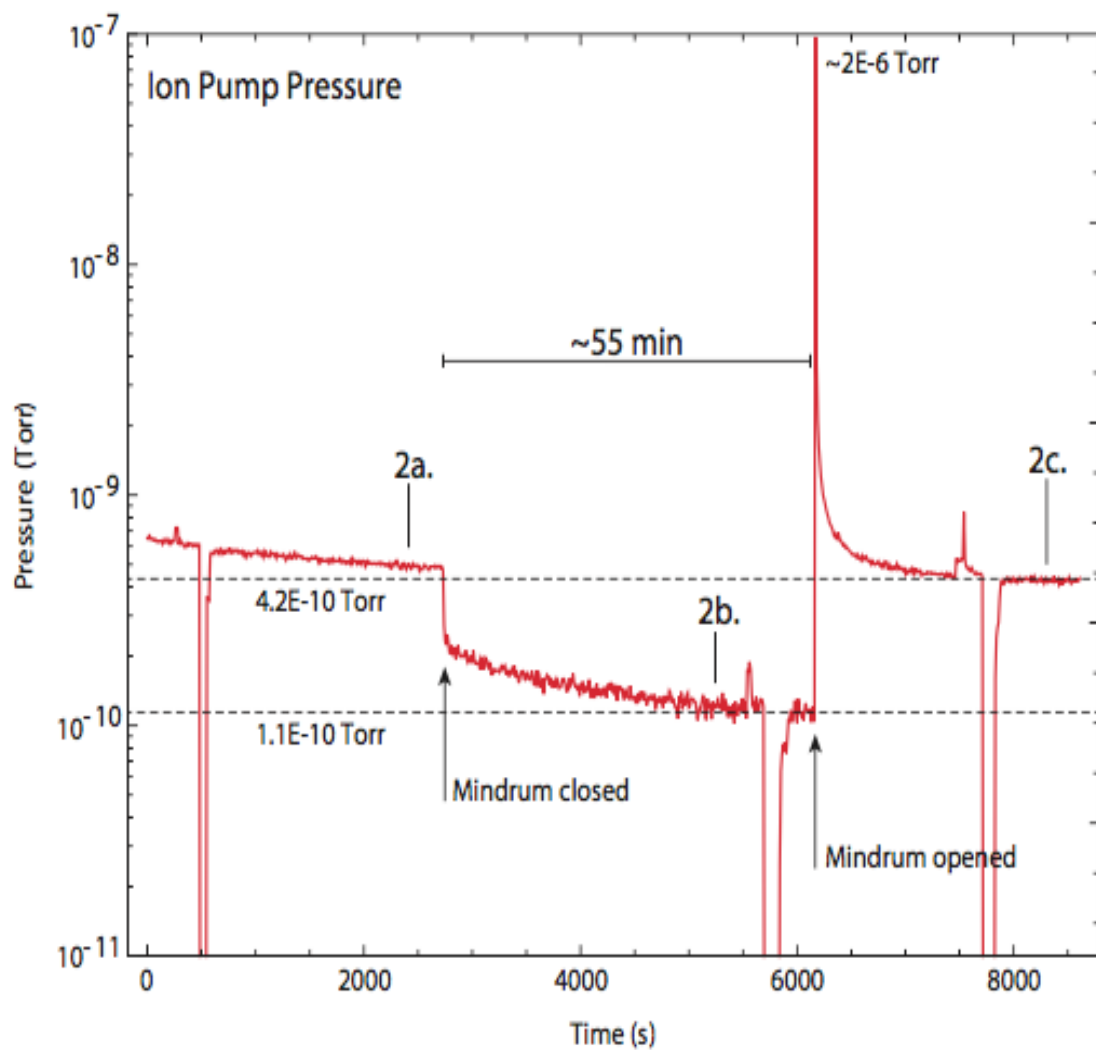
Mindrum Valve

Capillary



Filter

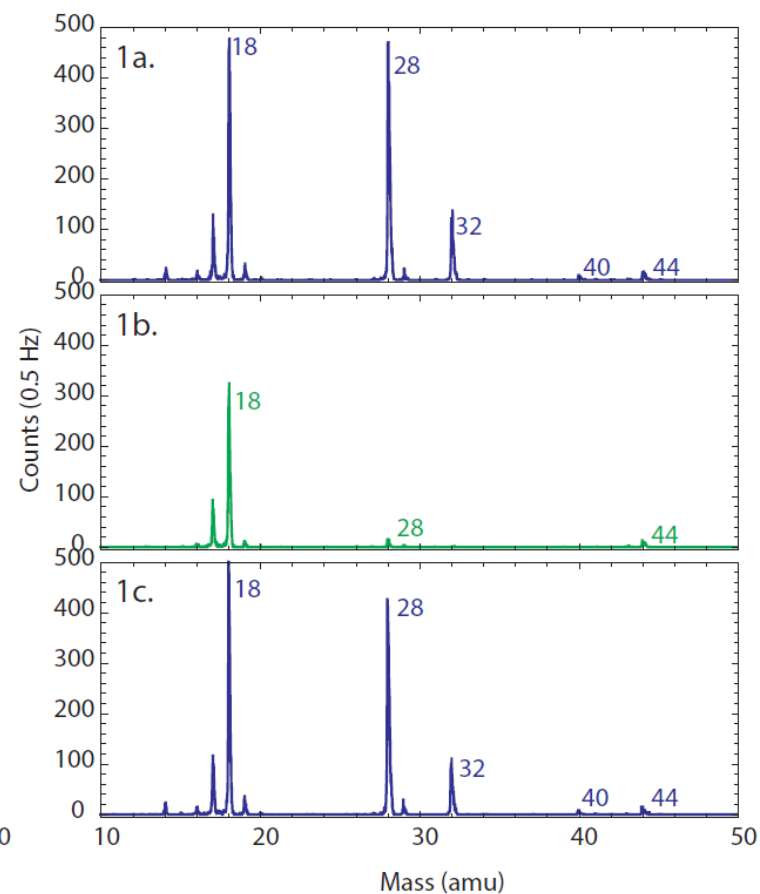
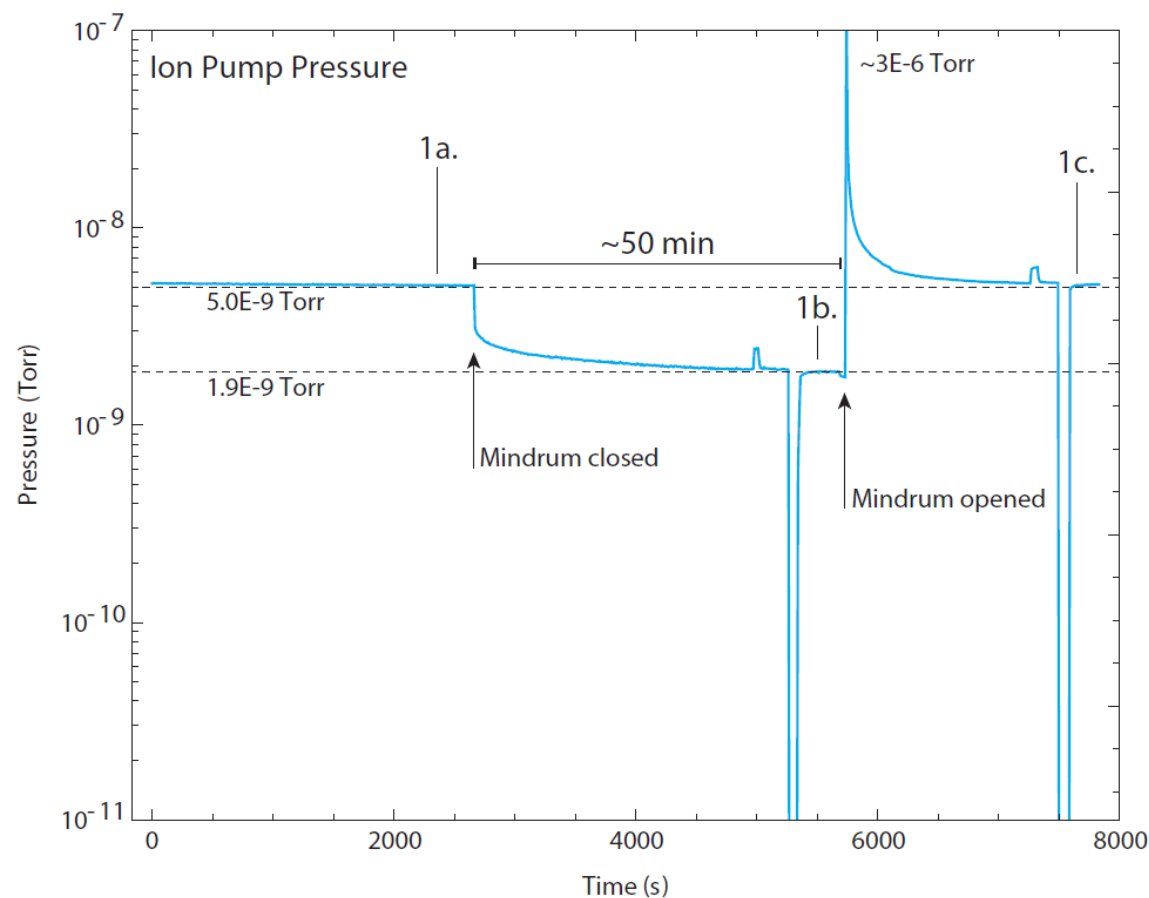
## S.A.M. MCA



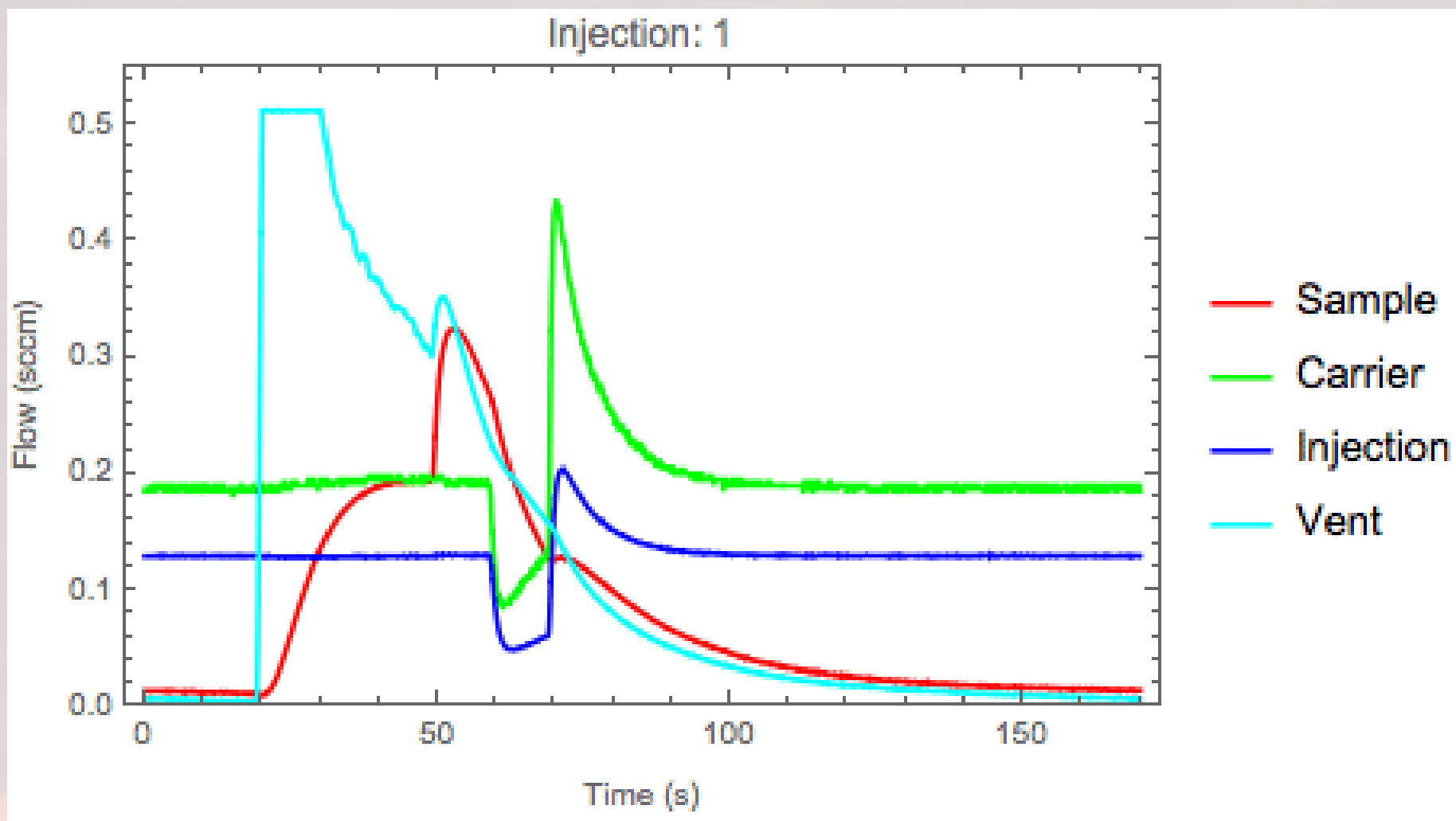
BG Subtracted: **N<sub>2</sub>: 75.9(1.2)%; O<sub>2</sub>: 22.4(6)%; Ar: 1.6(2)%; CO<sub>2</sub>: 500 PPM**



# S.A.M. MCA (No Getter)

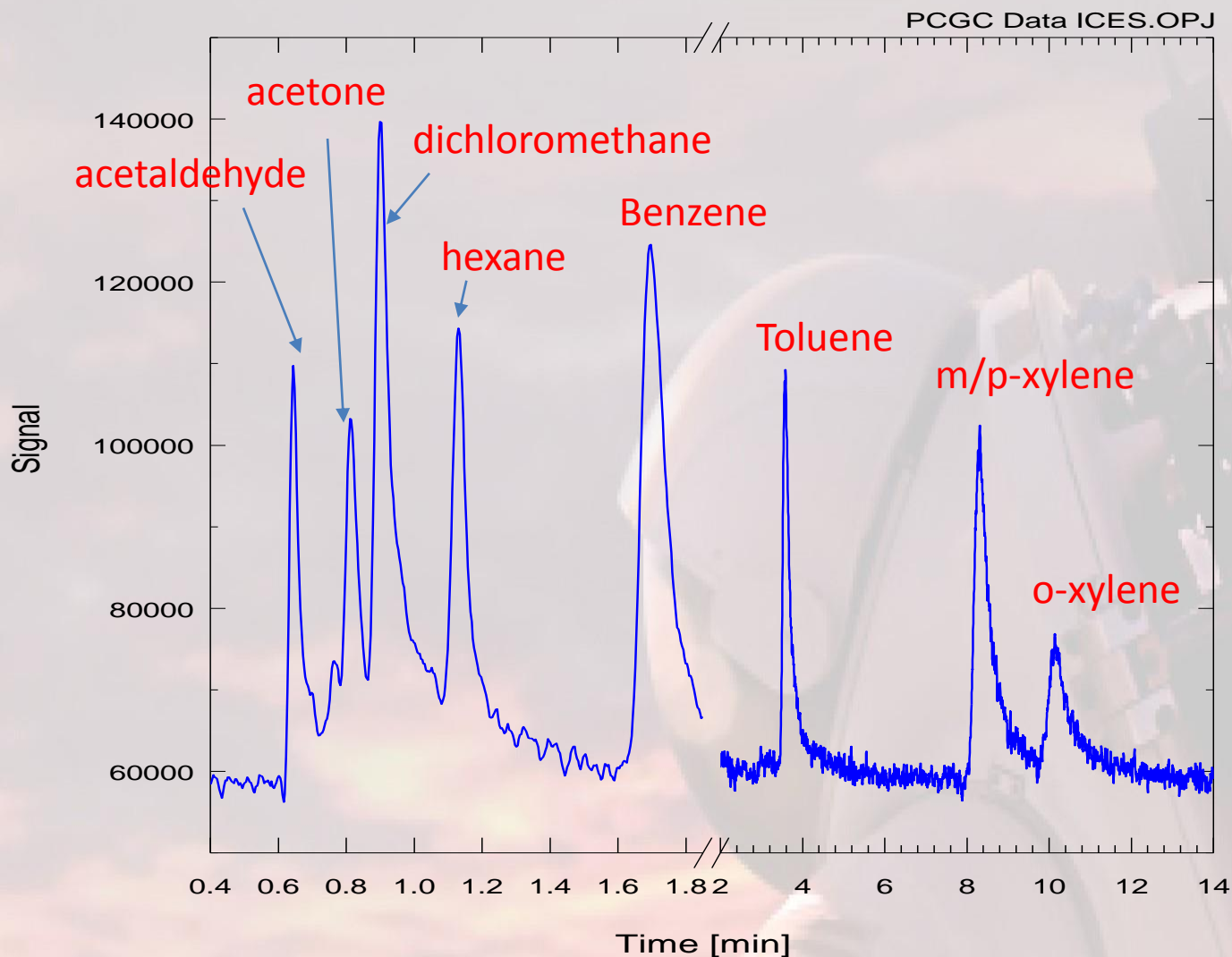


# S.A.M. GC Valve Check



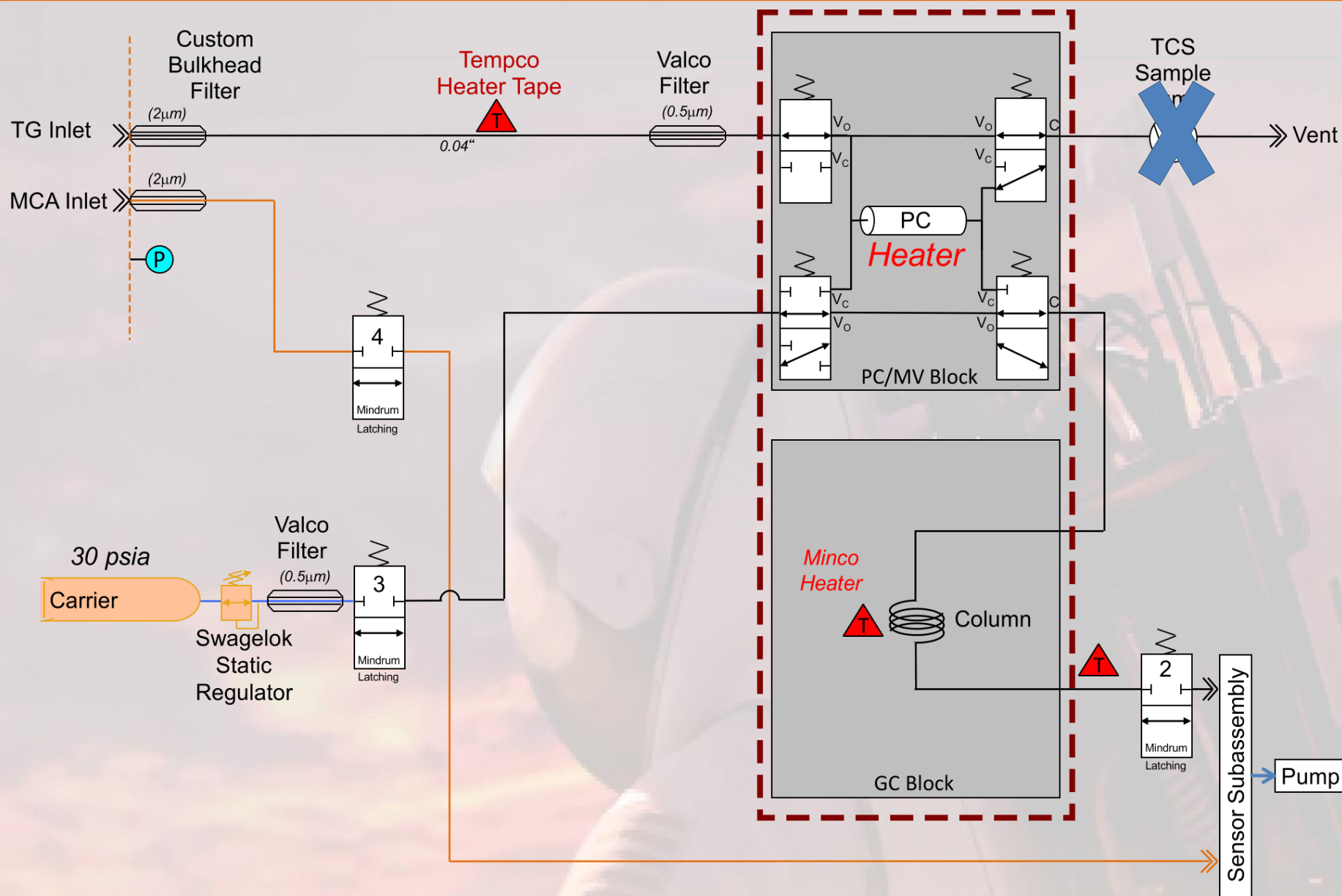


# GC Test: 4m OV-5 coated GC Column with 6psi head pressure



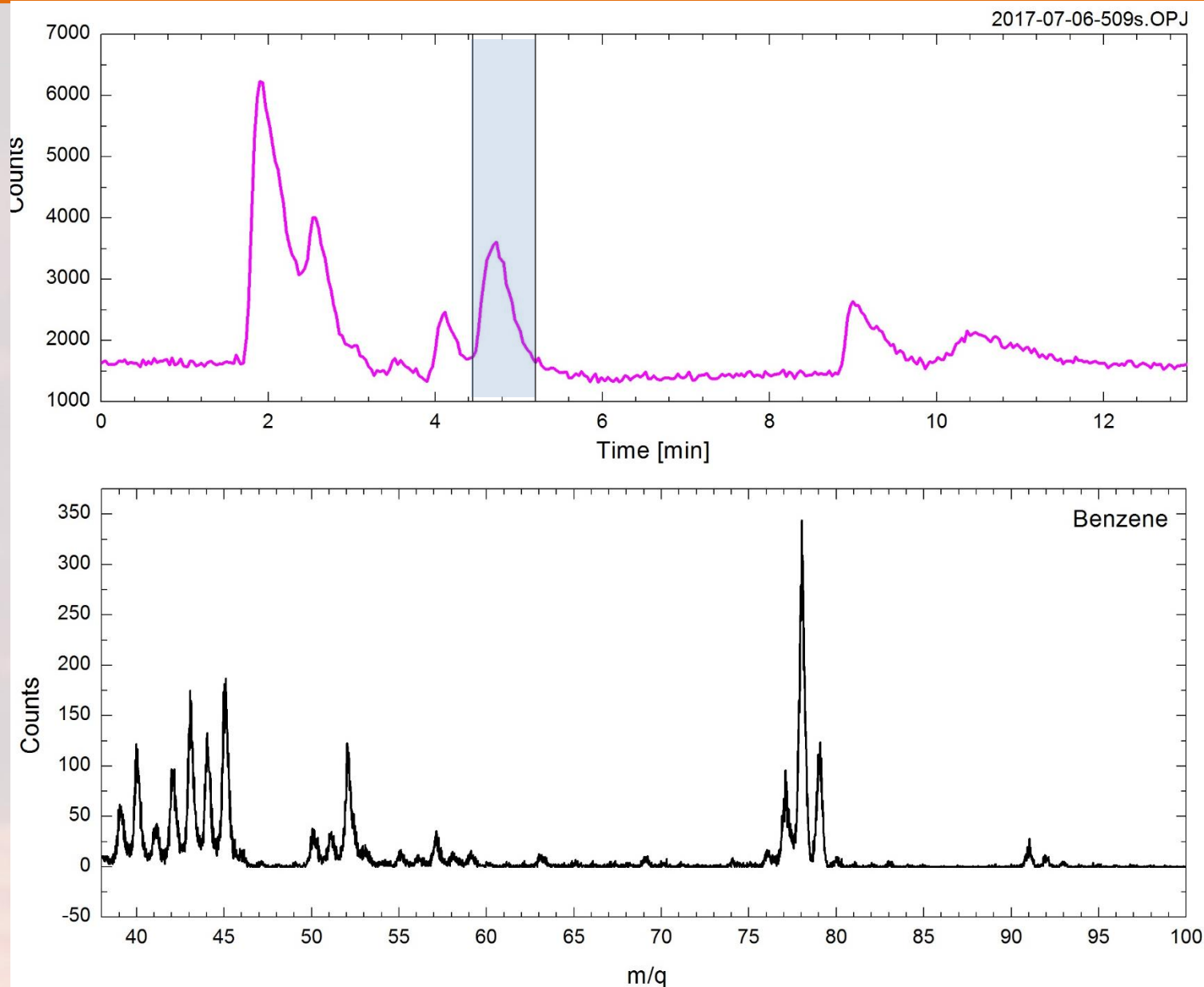
Methanol  
Ethanol  
2-propanol  
1-butanol  
Acetaldehyde  
Hexane  
Acetone  
Benzene  
Toluene  
o-xylene  
m-xylene  
p-xylene  
Dichloromethane

# S.A.M. Schematics

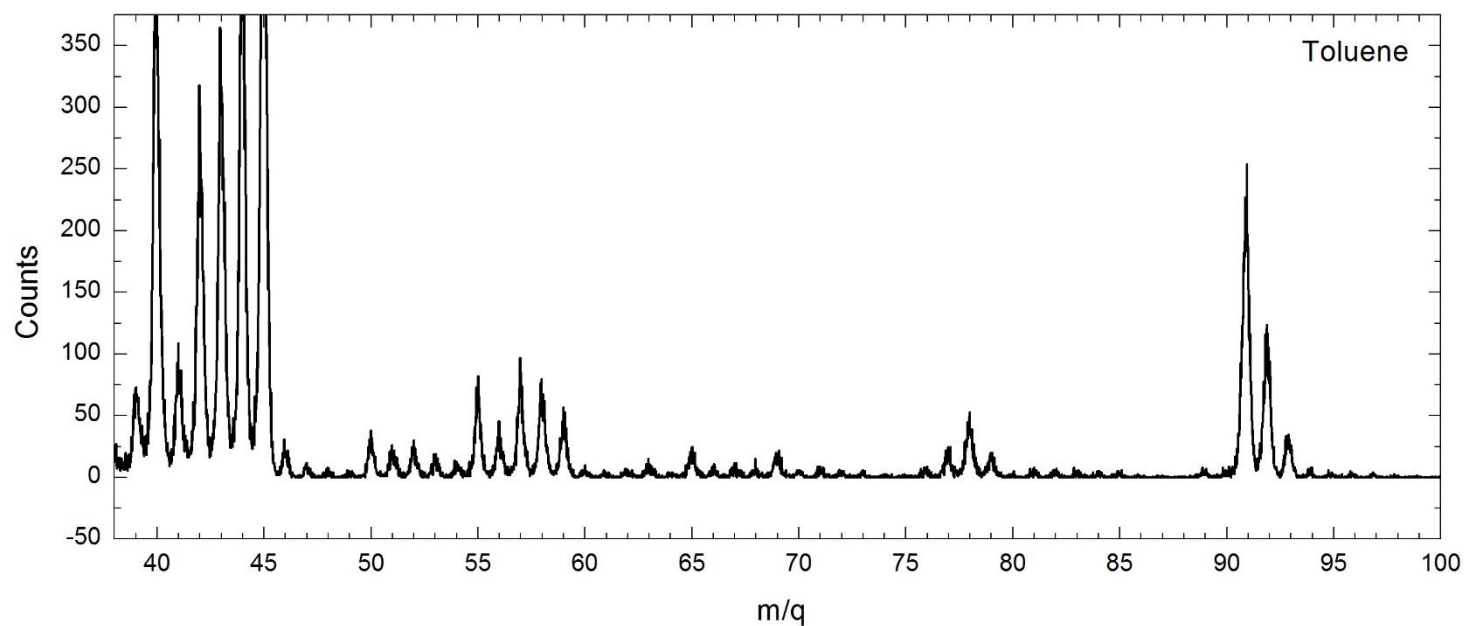
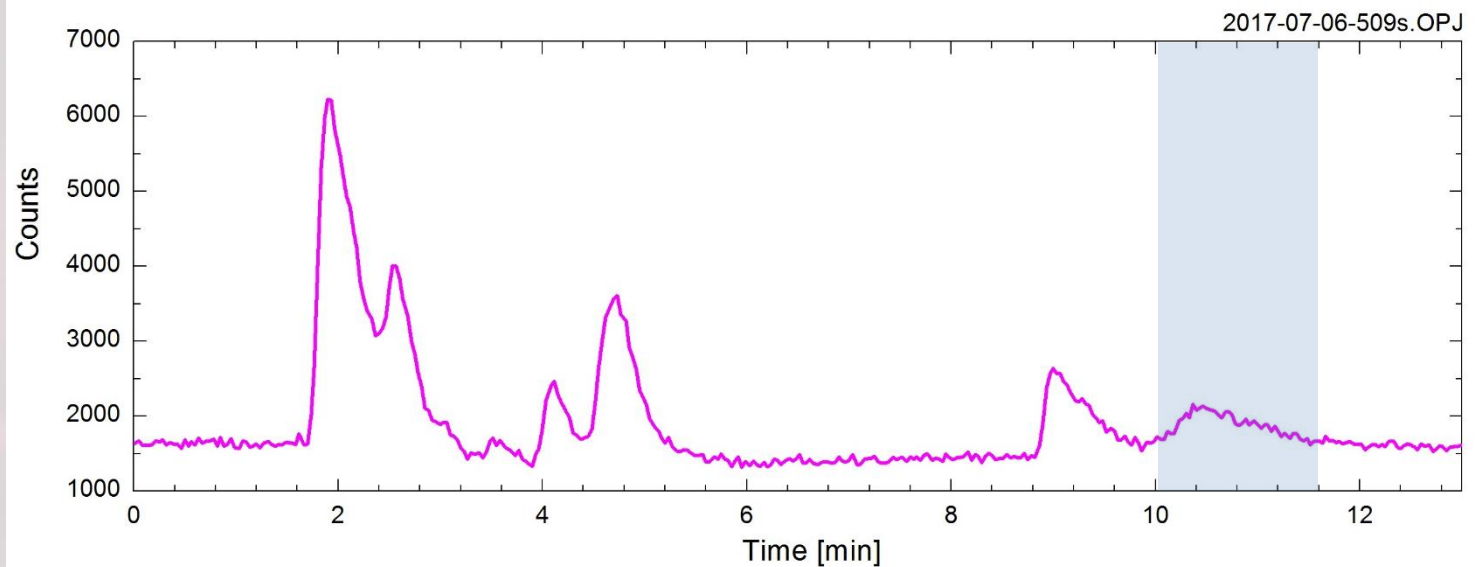




# S.A.M. GC Test: 4m OV-5 coated GC Column with 2psi head pressure

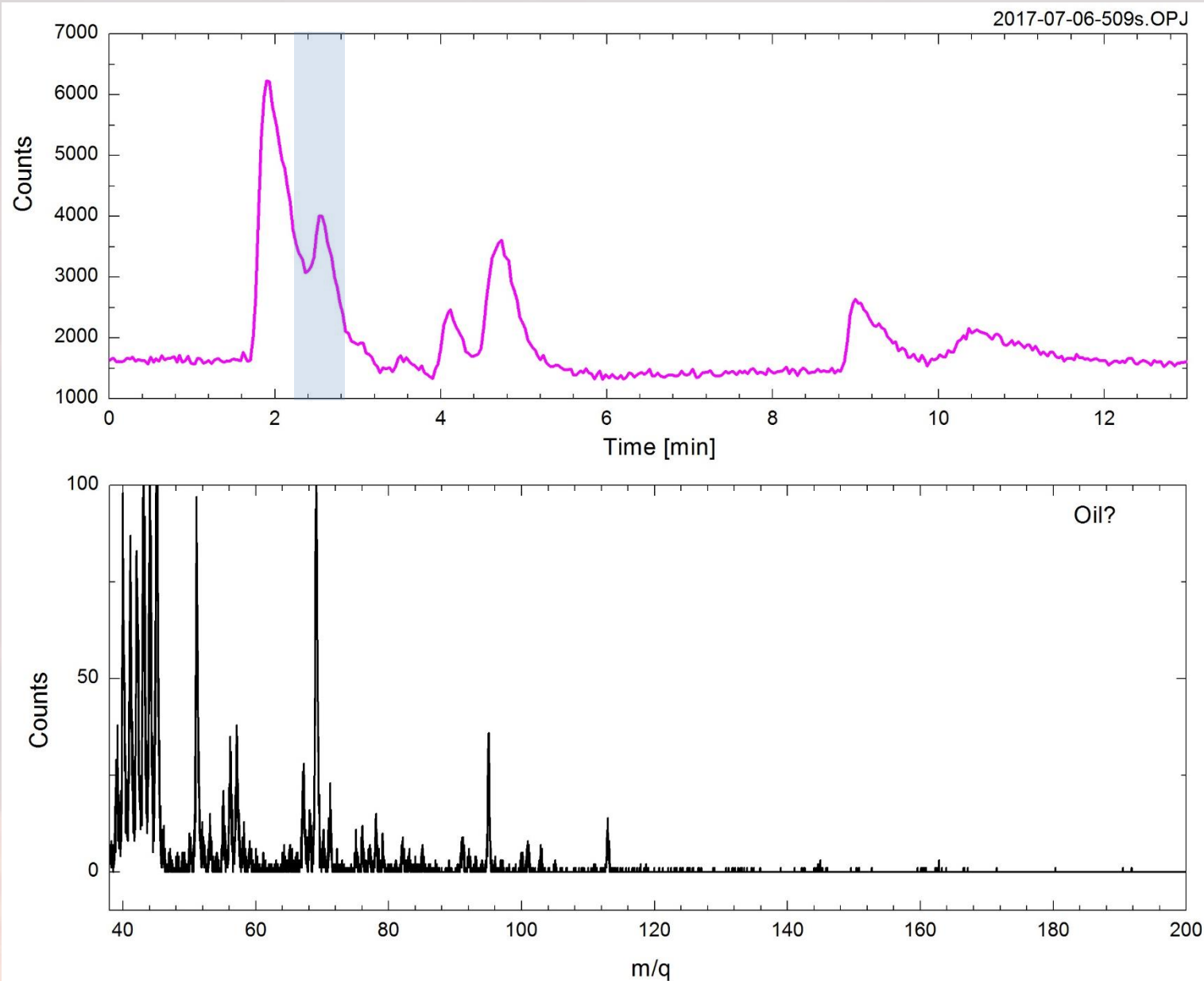


# S.A.M. GC Test: 4m OV-5 coated GC Column with 2psi head pressure

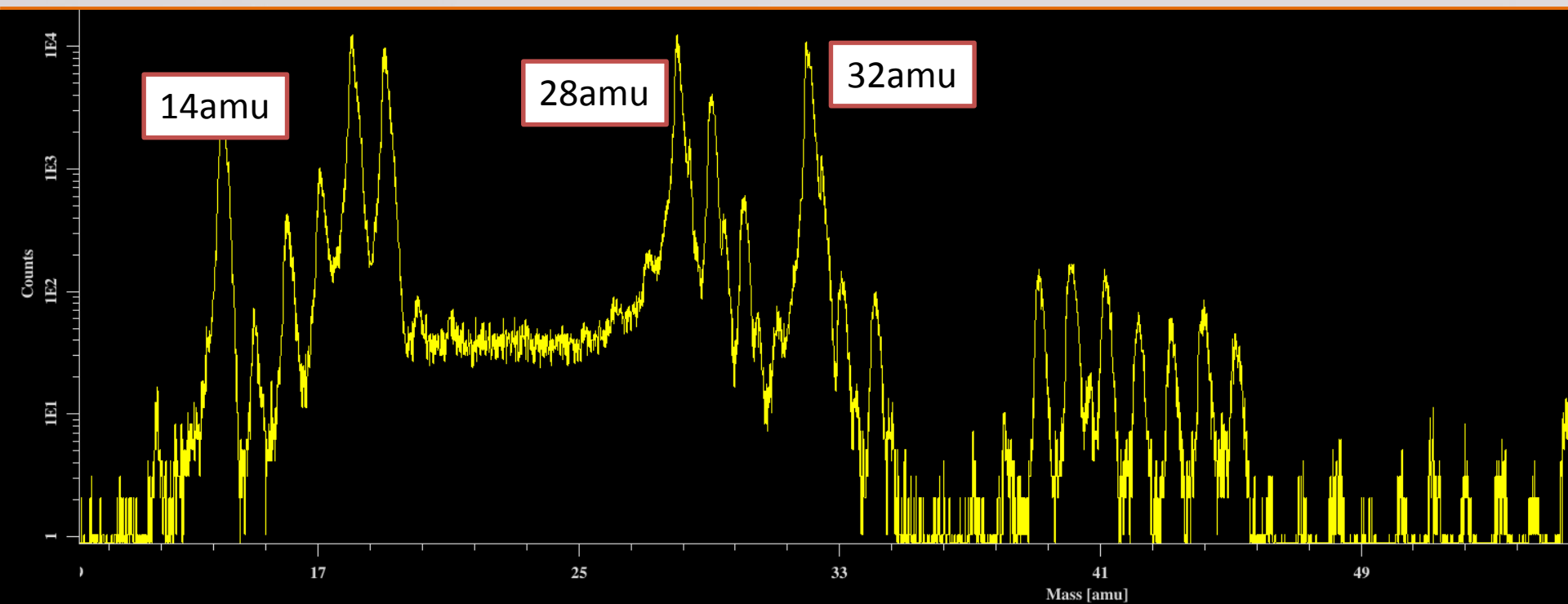




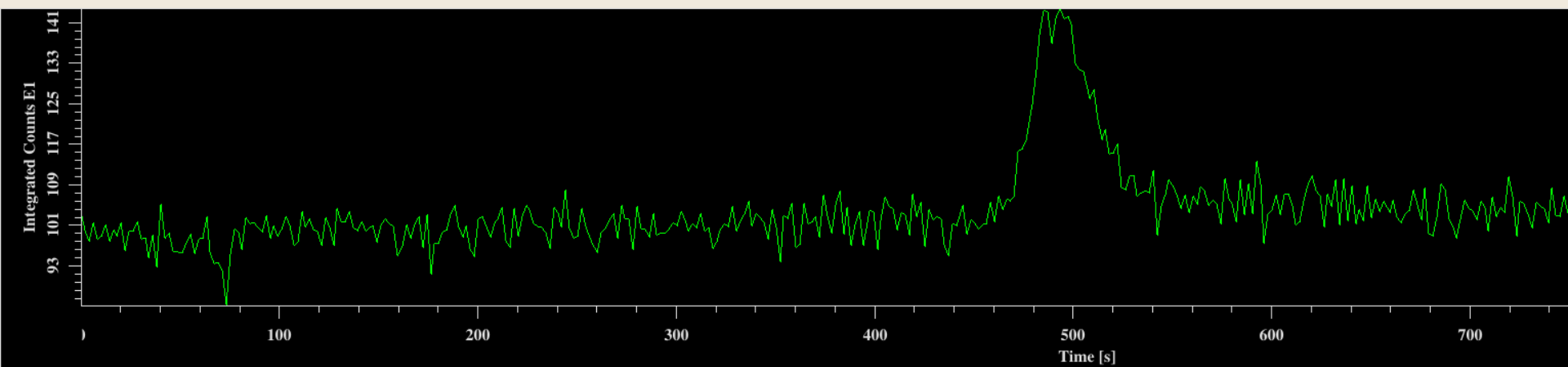
# S.A.M. GC Test: 4m OV-5 coated GC Column with 2psi head pressure



# S.A.M. GC Test: Low Mass Signal

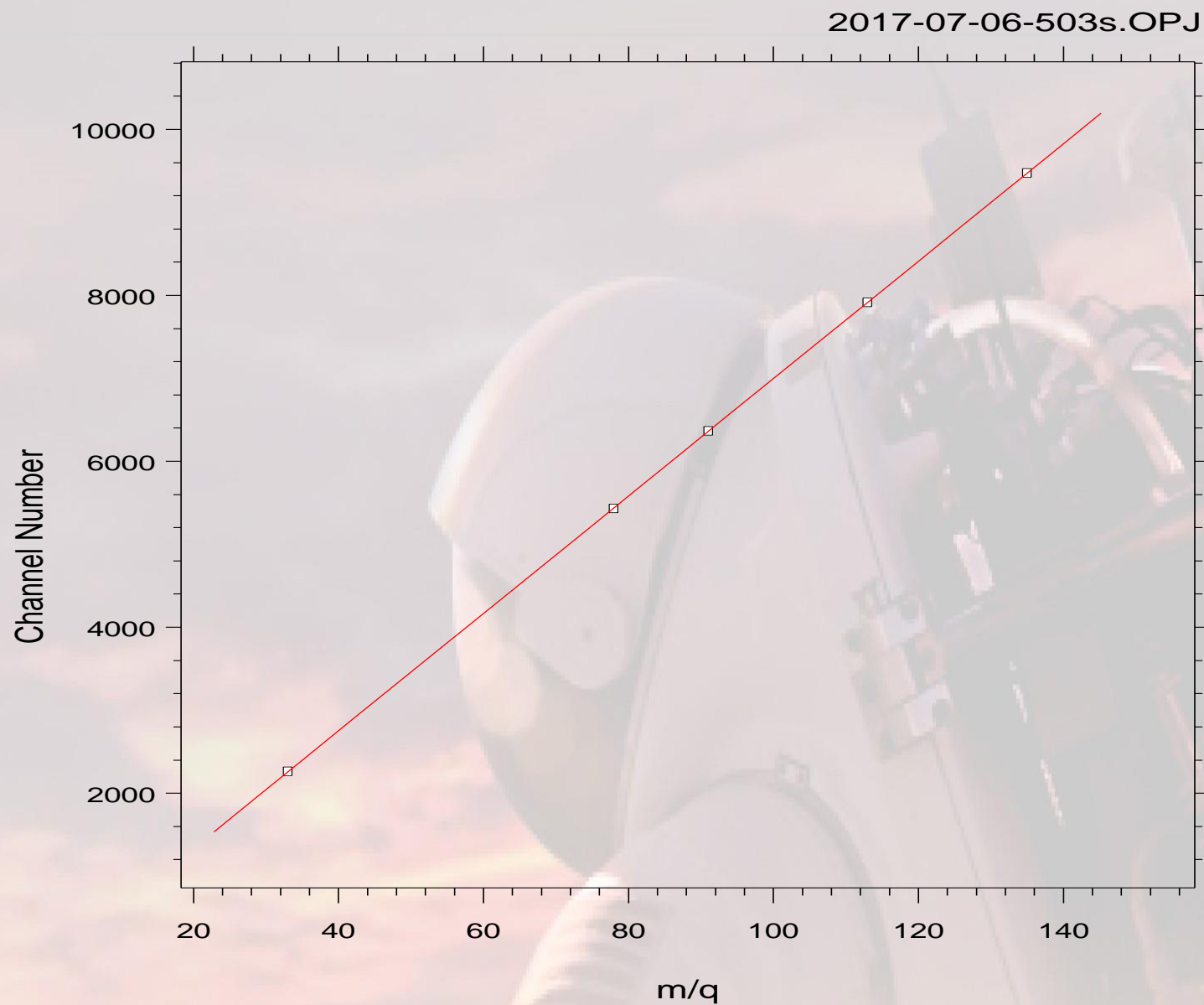


Total Counts vs Time





# S.A.M. Linearity



# Comparison between VCAM and S.A.M.

Parameter	VCAM	S.A.M.	Comment
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<i>Dimensions</i>	10.8" x 18.1" x 20.4"	<b>11.0"</b> x 8.75" x 7.5"	Reduce Volume
<i>Volume</i>	64.4 ℓ	<b>10.6 ℓ</b>	1/6 Volume
<i>Average Power During Measurement</i>	120 W	<b>30W (MCA); 35W (TG)</b>	1/3 Power
<i>Operation</i>	Hard Mount	Mobile	Portable
<i>Start-up Time</i>	2.5 hours	< 2 minutes	Tolerance to dormancy/on-off cycles
<i>Operation Mode</i>	On demand	Continuous MCA , TG on demand	Continuous operation
<i>Time to make an MCA Measurement</i>	3-5 Hrs	Every 2 seconds	Dramatically reduced response time
<i>Time to make a Trace VOC (TG) Measurement</i>	40 min	<b>14 min</b>	Reduce response time



# Conclusion

- The DM was put together and first round of tests performed
- Background operating pressure ( $<5\text{E-}10\text{Torr}$ ) achieved
- Operations: MCA mode and TG mode achieved ( $\sim 30\text{-}35\text{W}$  of power consumption without heating lamp)
- MCA leak tested with engineering model
- GC block component tests performed (GC, PC and micro-valves)
- GC block as hole was partially tested (problems with micro valves one out of 4)
- GC chromatography with integrated block presented (engineering model)

# Thank you!

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